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Object Tracking in Video Surveillance

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ABSTRACT -

Security video surveillance of important places such as banks, roads, crowded public places, borders, forests and train stations is monitored by automated video. The system we set up tries to find and follow moving objects. Moving objects and detection algorithms must be fast, reliable and durable to make video surveillance systems "intelligent". This technique uses background subtraction to detect moving objects in the foreground in a series of images. In video analysis, the first step of object detection is background subtraction, and the second step is masksampling. This study suggests using a set of classifiers to capture objects. The article ends with a discussion of different algorithms that can be used for object detection and more, many cutting-edge algorithms were implemented and tested in a real-world driving environment on our own platform. The paper concludes with a discussion of the different algorithms available for object detection.

Keywords: Background subtraction, foreground mask sampling, cascade classifier, etc.

INTRODUCTION

This project includes the use of time tracking software. This section discusses the project specifications. It also provides a high-level overview of the process, leaving design and implementation issues to be discussed in the relevant sections. Video analytics is increasingly in demand for many real-time applications in machine learning.

Object Tracking is the major segment with different areas of analysis:

- Suspicious activity detection
- Constant threat at public places
- Military applications

Intelligent video surveillance, vehicle tracking, human-computer interaction, military medicine, motion recognition and other applications. An important and difficult task in computer vision is trying to recognize, track and capture objects from images called films. Understanding and explaining behavior helps to understand and describe the behavior of objects rather than the computer operator. It tries to find moving objects in video files or security cameras. Search for one or more products using one camera, multiple cameras, or specific video files referred to as object tracking. The creation of new, powerful algorithms and their use in object tracking need the development of high-quality image sensors, enhancements to picture quality and resolution, and the exponential expansion of processing power. tracking and detecting objects.

During object tracking, a deep learning algorithm monitors an object's motion. In other words, the task at hand is to predict or estimate the positions and other crucial information of moving objects in a movie.

The method of object detection typically plays a role in object tracking. Here is a brief rundown of the steps:

- item detection, in which the algorithm identifies and classifies the item by enclosing it in a bounding box.
- Giving each thing a special identifying number (ID).
- Storing the pertinent data while tracking the identified item as it travels across the frames.

All of the aforementioned details enable us to provide a concise overview of object identification and tracking techniques. To distinguish the object that has to be tracked, the backdrop must always be clean of extraneous objects before seeing the tracked output.

Several methods are used in this technique to help find the item and tell it apart from its surroundings.

Here are a few popular techniques for tracking objects:

A. Point Monitoring

Moving objects are represented by their feature points during tracking in an image structure. Point tracking is a challenging issue, especially when there are object occlusions and incorrect object detections. By thresholding at the time of identification of these locations, recognition may be accomplished rather easily.

B. Kernel Based Tracking

In order to accomplish kernel tracking, a moving object that is represented by an embryonic object area is often computed from one frame to the next. Typically, the motion of the object takes the form of a parametric motion, such translation, conformal, affine, etc. These techniques differ in terms of the number of monitored objects, the presence representation that is employed, and the technique for approximating object motion.

C. Approach to Silhouette-Based Tracking

Simple geometric forms are unable to accurately characterize some objects due to their complicated shapes, such as hands, fingers, and shoulders. The items' shapes may be accurately described using silhouette-based approaches. Using an object model created from earlier frames, the goal of a silhouette-based object tracking is to locate the object region in every frame. capable of handling a range of object forms, as well as object splitting and merging due to occlusion.The most popular and extensively applied methods for object identification and tracking are those stated above.

item tracking, which entails locating and tracking an item's movement over time, is frequently used in combination with object detection. Occlusions, changes in illumination, and other circumstances that might make it tough to maintain a steady track of the object can make object tracking challenging. For applications like video monitoring and sports analysis, it may be helpful. To monitor an object's movement over time, object tracking is frequently used in combination with object detection. There are several approaches to object detection, each having advantages and disadvantages.

LITERATURE REVIEW

This study proposes an automated item recognition and tracking system. To swiftly and precisely extract moving objects, the detector combines a mixed Gaussian background modelling approach with a HOG and SVM detection model. In addition, we use a simple association technique to connect the detector and KCF tracker.During this procedure, the tracking module completes data association and anti-occlusion tasks. The recommended method makes use of the cooperative working mode of the detection and tracking modules. The detection and tracking module may get better results by making the final decision on each frame in this way. Both of its stated objectives—improving detection precision and automatically initializing the location of the item in the first frame—are achieved. Shengzhi Du et al.[1] have used intelligent surveillance films to demonstrate the appropriate operation of the suggested technique.Taekyung Kim et al. [2] describe a block matching-based backdrop generation and non-rigid form tracking technique in this study. By addressing intrinsic issues with current block matching techniques, the suggested adaptive backdrop generation module acts as a crucial building element for reliable tracking. The suggested shape tracking module extracts the moving area of the object based on SCPs after producing the backdrop.The combination of block matching and background generation (BMBG), which permits reliable tracking even with occlusion, is a significant contribution of this study. The computer-generated fish picture and the outside image have been used in several investigations. The suggested technique may offer reliable tracking with many objects, occlusion, and a complex background, according to experimental results.A non-rigid form tracking algorithm and a backdrop generation technique based on block matching by Hetal K. Chavada et al.[3] are presented in this paper. The proposed adaptive background generation module serves as a fundamental building component for accurate tracking by resolving inherent problems with existing block matching algorithms. After creating the backdrop, the proposed shape tracking module removes the moving portion of the object based on SCPs. This study makes a substantial contribution by combining block matching and background generation (BMBG), which enables accurate tracking even when there is occlusion. Numerous investigations have made use of both the outside picture and the computer-generated fish image. According to experimental findings, the suggested approach can give accurate tracking even when there are multiple objects, occlusion, and a complicated backdrop.The recommended method was used on a video sequence that was compressed and converted to.avi format after being recorded at 115 frames per second. An item was initially identified based on the image input, and it was tracked in subsequent frames. The bounding box placed on top of the observed object's coordinates was also evaluated and tracked. Without missing a frame, the experimental method was able to overlay the bounding box and track objects. The Mean Shift Algorithm could effectively produce an image sequence after being fully implemented. The effectiveness of the method was assessed by Garima Mathur et al. by successfully tracking the user-defined object and executing the overlay function on the discovered item. [4]This article created a high performance tracking algorithm for the surveillance system. Even when people are interacting or when the occlusion is caused by other foreground objects, our solution uses object blobs and velocity to track several moving objects in consecutive frames without the need of color signals or appearance models.The relationship between the subject's proximity to the camera and the camera's distance from the subject causes people to move more. As a consequence, the occlusion problem may be successfully handled by our algorithm's adjustable search range. The failure of foreground detection in situations when the foreground and backdrop are the same can also be fixed using the object grouping approach. More than 94% of these correspondences match accurately, according simulation results by Tsung-Han Tsai et al. [5].

METHODOLOGY

1 Input Video

Various video input formats, including GIF (Graphics Interchange Format), SVG (Scalable Vector Graphics), MP4 (Moving Picture Experts Group), AVI (Audio Video Interleave), etc., are available. Throughout the procedure, we fed MP4 video file into this system for background removal.

2. Video to Frame Conversion

The video is the most important kind of multi-media. A group of pictures (GOP) is a collection of frames. Due to the rapid advancement of video indexing, editing, and transcoding technologies, video analysis and segmentation are more important than ever. Frame extraction is essential for breaking down a long video sequence into manageable chunks for further processing. Because good frame extraction collects the most important information in the movie, distributing video data is quick and easy. In order to lessen network load, we transfer crucial data throughout the network.

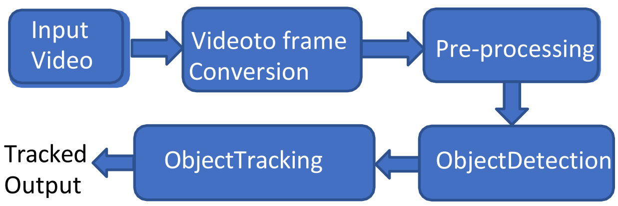

Figure1 : Block Diagram of System

3. Pre-processing

A critical step in pre-processing is transforming grayscale photos into white-scale representations. The grayscale image is converted into a binary image, where pixel values can either be white or black depending on a threshold. Lower intensities are set as black (0), while higher intensities set as white (255) over the threshold. The following image processing is made easier by concentrating on the presence of objects rather than fluctuations in intensity. It improves computing effectiveness and makes object tracking quicker and more precise.

The video that you wish to convert to grayscale is loaded into the file. We have utilized a video processing framework or package that accepts video input, such as Python's OpenCV. then went through the video's frames one by one. Each frame was processed individually using a loop. Divide each frame into its red, green, and blue three-color channels, much as how a picture is made grayscale. Utilizing one of the previously described techniques (average, luminosity, or lightness), determined the grayscale value for each pixel in the picture. then used the selected technique on the associated pixel values for each colour channel. Then, using the estimated grayscale values for each pixel, make a new frame with a solitary grayscale channel. The grayscale frame should have the same dimensions as the original frame. At this point, we chose whether to continue processing the grayscale frame, carry out more preprocessing operations, or save it to a new video file. Up until all of the video's frames have been processed, the identical methods have been repeated for each succeeding frame. Finally, save the edited grayscale video to a new file or use it straight away for additional processing or analysis.

4. Object Detection

Adaptive Background Subtraction is a method that may be used to detect objects using the background subtraction approach without thresholding. This strategy handles gradual changes in the backdrop and lighting circumstances by dynamically adapting the background model. Similar to the conventional background subtraction technique, the first step is to capture and analyze a set of frames without any foreground objects to produce a background model. Instead of immediately deducting the previous frame from the backdrop model in each succeeding frame, an updating technique is used. The backdrop model is gradually modified by the update process to reflect background changes. The altered backdrop model is subtracted from the current frame to create the difference image. The areas in this difference picture that might include foreground items are highlighted. Similar to the conventional background subtraction procedure, post-processing methods including morphological operations (such as erosion and dilation) can be used on the difference picture to eliminate noise and minute artefacts. On the difference picture that has been processed, connected component analysis is used to locate and name the various foreground items. Each object with a label relates to a possible thing in the scene that may be detected. The adaptive background subtraction approach is more suited for situations where the backdrop is dynamic or when lighting conditions fluctuate since it can manage gradual changes in the background. However, it can still have trouble coping with severe occlusions or abrupt shifts. Advanced methods like deep learning-based approaches are frequently favoured for object recognition that is more reliable and accurate.

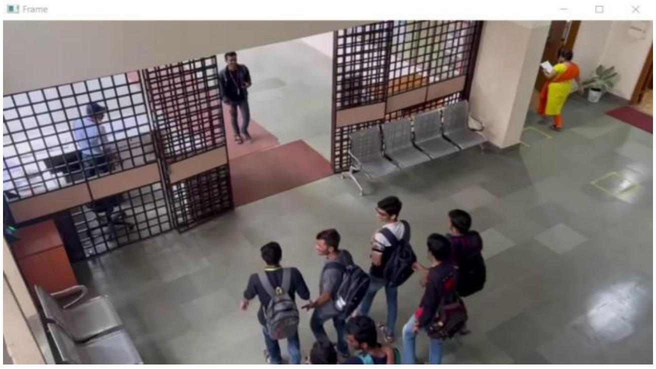

Figure 2 (a): Current Image from PICT Campus Video Database

Figure 2 (a) shows the to-be-detected items in the frame that are taken from a database called "PICT campus video.mp4" while the backdrop is also recorded. In the image above, the background was still, but the items were moving.

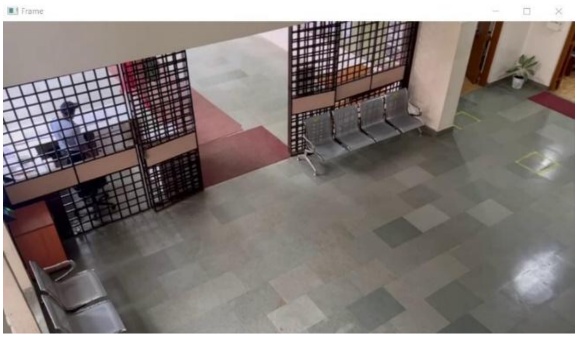

Figure 2 (b): Background Image from PICT Campus Video Database

Figure 2.b depicts the image's backdrop, which is a stationary background image with no other things in it.

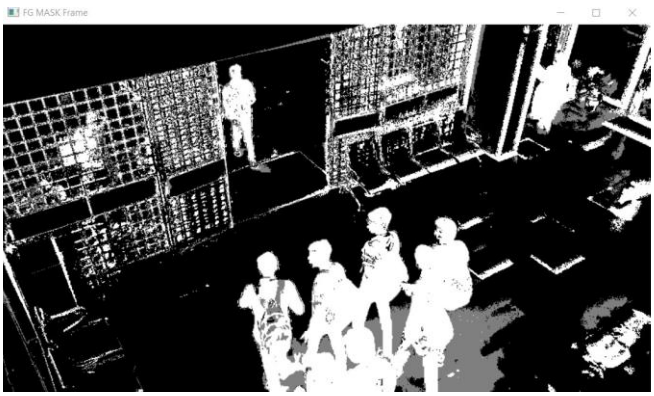

Figure 2(c) : Background Subtracted Image from PICT Campus Video Database

We can plainly see the items being recognized and the real picture being subtracted from the background image in Figure 2 (c), which is the outcome of the background subtraction. So, the result is the image you see above.

5. Object Tracking

The YOLO (You Only Look Once) method comprises the following phases for object tracking. In order to identify items of interest, YOLO is initially applied to the first frame of a movie, producing bounding box predictions and class labels. After that, the discovered items are initialised for tracking and given distinctive identities. Based on prior locations and velocities, the object's motion is anticipated and updated in following frames. Occlusion management techniques are used to deal with instances when objects become partially concealed. To fix any tracking mistakes and keep the object tracking process accurate, the YOLO algorithm is periodically executed again. The YOLO algorithm is used to offer real-time and effective object tracking employing this combination strategy of initial detection and subsequent tracking.

Figure 3: Tracked Output of Video Database Hotel Entry

The tracked output for the video database "Hotel Entry.mp4" can be shown in Figure 3. Humans are the subject of this discussion and they also symbolize the class number 0 that is assigned to humans when they are put through testing. Additionally, the targets of interest are tracked like humans while being hidden by another human

CONCLUSION

In this study, we have reviewed the many methods that may be applied to object detection. To distinguish between foreground and background items in object detection, background removal is a frequent approach. A list of elements can be sorted in ascending or descending order using the straightforward sorting technique known as bubble sort. Although both methods have been widely employed in object identification, further study and development is still needed.

The automatic identification and localization of items of interest inside video feeds are made possible by object detection, which has grown to be a crucial method in video surveillance systems. By identifying possible threats or suspicious activity in real-time, object detection can assist increase public safety and security by utilizing cutting-edge computer vision techniques including background removal, deep learning-based algorithms, and object tracking. Intrusion detection, population monitoring, traffic monitoring, object tracking, and abandoned object identification are just a few of the many video surveillance uses for object detection. The potential for future study and development in object detection to boost its precision, speed, and resilience and make it an even more formidable instrument for boosting public safety and security is enormous as technology develops.

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